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UNIT TERMINAL OBJECTIVE

- 5-11 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement a management plan for the patient with infectious and communicable diseases.

COGNITIVE OBJECTIVES

At the completion of this unit, the paramedic student will be able to:

- 5-11.1 Review the specific anatomy and physiology pertinent to infectious and communicable diseases. (C-1)
- 5-11.2 Define specific terminology identified with infectious/ communicable diseases. (C-1)
- 5-11.3 Discuss public health principles relevant to infectious/ communicable disease. (C-1)
- 5-11.4 Identify public health agencies involved in the prevention and management of disease outbreaks. (C-1)
- 5-11.5 List and describe the steps of an infectious process. (C-1)
- 5-11.6 Discuss the risks associated with infection. (C-1)
- 5-11.7 List and describe the stages of infectious diseases. (C-1)
- 5-11.8 List and describe infectious agents, including bacteria, viruses, fungi, protozoans, and helminths (worms). (C-1)
- 5-11.9 Describe host defense mechanisms against infection. (C-1)
- 5-11.10 Describe characteristics of the immune system, including the categories of white blood cells, the reticuloendothelial system (RES), and the complement system. (C-1)
- 5-11.11 Describe the processes of the immune system defenses, to include humoral and cell-mediated immunity. (C-1)
- 5-11.12 In specific diseases, identify and discuss the issues of personal isolation. (C-1)
- 5-11.13 Describe and discuss the rationale for the various types of PPE. (C-1)
- 5-11.14 Discuss what constitutes a significant exposure to an infectious agent. (C-1)
- 5-11.15 Describe the assessment of a patient suspected of, or identified as having, an infectious/ communicable disease. (C-1)
- 5-11.16 Discuss the proper disposal of contaminated supplies (sharps, gauze sponges, tourniquets, etc.). (C-1)
- 5-11.17 Discuss disinfection of patient care equipment, and areas in which care of the patient occurred. (C-1)
- 5-11.18 Discuss the following relative to HIV - causative agent, body systems affected and potential secondary complications, modes of transmission, the seroconversion rate after direct significant exposure, susceptibility and resistance, signs and symptoms, specific patient management and personal protective measures, and immunization. (C-1)
- 5-11.19 Discuss Hepatitis A (infectious hepatitis), including the causative agent, body systems affected and potential secondary complications, routes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.20 Discuss Hepatitis B (serum hepatitis), including the causative agent, the organ affected and potential secondary complications, routes of transmission, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.21 Discuss the susceptibility and resistance to Hepatitis B. (C-1)
- 5-11.22 Discuss Hepatitis C, including the causative agent, the organ affected, routes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization and control measures. (C-1)
- 5-11.23 Discuss Hepatitis D (Hepatitis delta virus), including the causative agent, the organ affected, routes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization and control measures. (C-1)
- 5-11.24 Discuss Hepatitis E, including the causative agent, the organ affected, routes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization and control measures. (C-1)
- 5-11.25 Discuss tuberculosis, including the causative agent, body systems affected and secondary complications.

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routes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization and control measures. (C-1)

- 5-11.26 Discuss meningococcal meningitis (spinal meningitis), including causative organisms, tissues affected, modes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization and control measures. (C-1)
- 5-11.27 Discuss other infectious agents known to cause meningitis including streptococcus pneumonia, hemophilus influenza type b, and other varieties of viruses. (C-1)
- 5-11.28 Discuss pneumonia, including causative organisms, body systems affected, routes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.29 Discuss tetanus, including the causative organism, the body system affected, modes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.30 Discuss rabies and hantavirus as they apply to regional environmental exposures, including the causative organisms, the body systems affected, routes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization and control measures. (C-1)
- 5-11.31 Identify pediatric viral diseases. (C-3)
- 5-11.32 Discuss chickenpox, including the causative organism, the body system affected, mode of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization and control measures. (C-1)
- 5-11.33 Discuss mumps, including the causative organism, the body organs and systems affected, mode of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.34 Discuss rubella (German measles), including the causative agent, the body tissues and systems affected, modes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.35 Discuss measles (rubeola, hard measles), including the causative organism, the body tissues, organs, and systems affected, mode of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.36 Discuss the importance of immunization, and those diseases, especially in the pediatric population, which warrant widespread immunization (MMR). (C-1)
- 5-11.37 Discuss pertussis (whooping cough), including the causative organism, the body organs affected, mode of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.38 Discuss influenza, including causative organisms, the body system affected, mode of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.39 Discuss mononucleosis, including the causative organisms, the body regions, organs, and systems affected, modes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.40 Discuss herpes simplex type 1, including the causative organism, the body regions and system affected, modes of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.41 Discuss the characteristics of, and organisms associated with, febrile and afebrile respiratory disease, to include bronchiolitis, bronchitis, laryngitis, croup, epiglottitis, and the common cold. (C-1)
- 5-11.42 Discuss syphilis, including the causative organism, the body regions, organs, and systems affected, modes of transmission, susceptibility and resistance, stages of signs and symptoms, patient management and protective measures, and immunization. (C-1)
- 5-11.43 Discuss gonorrhea, including the causative organism, the body organs and associated structures

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affected, mode of transmission, susceptibility and resistance, signs and symptoms, patient management and protective measures, and immunization. (C-1)

- ## AFFECTIVE OBJECTIVES

- 5-11.53 Advocate compliance with standards and guidelines by role modeling adherence to universal/ standard precautions and BSI. (A-1)
- 5-11.54 Value the importance of immunization, especially in children and populations at risk. (A-1)
- 5-11.55 Value the safe management of a patient with an infectious/ communicable disease. (A-2)
- 5-11.56 Advocate respect for the feelings of patients, family, and others at the scene of an infectious/ communicable disease. (A-2)
- 5-11.57 Advocate empathy for a patient with an infectious/ communicable disease. (A-2)
- 5-11.58 Value the importance of infectious/ communicable disease control. (A-2)
- 5-11.59 Consistently demonstrate the use of body substance isolation. (A-2)

At the completion of this unit, the paramedic student will be able to:

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DECLARATIVE

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3. Transmission of infectious agent to the host
4. Development and/ or manifestations of clinical disease dependent on several factors
 - a. Virulence (degree of pathogenicity) of the agent - strength of the microorganisms to infect the host
 - b. Number of infectious agents (dose)
 - c. Resistance (immune status) of the host
 - d. Correct mode of entry
 - e. Virulence, dose, resistance, and correct mode of entry must all exist to create a risk of exposure
 - (1) Does not mean a person will become infected
 - (2) Exposure, with all necessary risk factors, does not necessarily equal infection
5. Life-cycle of the infectious agent
 - a. Demographics of host
 - (1) Populations and their ability to move internationally
 - (2) Age distributions
 - (3) Socioeconomic considerations
 - (4) Population settling and migration dictated by religion
 - b. Genetic factors
 - c. Efficacy of therapeutic interventions once infection has been established
6. Risk of infection is
 - a. Theoretical - the possibility of transmission is acknowledged to have the potential to occur, but has not been reported
 - b. Measurable - some factors of infectious agent transmission, and the risks associated with those factors, are known or deduced from reported data

B. Stages of an infectious disease (NOTE - The numerical order does not imply that this is a chronological progression)

1. Latent period
 - a. Period after infection of a host when the infectious agent cannot be transmitted to another host or cause clinically significant symptoms
2. Communicable period
 - a. Period after an infection when the infectious agent can be transmitted to another host
 - b. Clinically significant symptoms from the infection may be manifested during this period
3. Incubation period
 - a. Time interval between exposure to an infectious agent and the first appearance of symptoms associated with the infection
4. Window phase
 - a. A period after infection in which antigen is present, but no detectable antibody
5. Disease period
 - a. Time interval between the first appearance of symptoms associated with the infection and resolution of those symptoms, or death
 - b. Resolution of symptoms does not mean that the infectious agent is destroyed

C. Infectious agents - an overview

1. Bacteria
 - a. Prokaryotic - nuclear material not contained within a distinct envelope
 - b. Self-reproducing without host cell
 - c. Signs and symptoms depend on cells and tissues that are infected
 - d. Toxins - often more lethal than the bacterium itself

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- (1) Endotoxins
 - (a) Chemicals, usually proteins
 - (b) Integral parts of a bacteria's outer membrane and steadily shed from living bacteria
 - (2) Exotoxin
 - (a) Proteins released by bacteria that can cause disease symptoms by acting as neurotoxins or enterotoxins
 - e. Lysis of bacteria may release endotoxins
 - f. Can be localized or systemic infection
- 2. Viruses
 - a. Must invade host cells to reproduce
 - b. Cannot survive outside of host cell
 - c. Other microorganisms
 - d. Eukaryotic - nuclear material contained within a distinct envelope
- 3. Fungi
 - a. Protective capsules surround the cell wall and protect the fungi from phagocytes
- 4. Protozoans
- 5. Helminths (worms) - not necessarily microorganisms

A. Nonspecific and surface defense mechanisms (the body's own PPE)

1. Skin
 - a. First line of defense against infection
 2. Respiratory system
 - a. Turbinates
 - (1) Create turbulent air flow
 - (2) Nasal hairs trap foreign material
 - b. Mucous can trap and kill alien material and is eliminated as sputum (from pharynx) or phlegm (generally from larynx and below)
 - c. Mucociliary escalator - moves pollutants trapped by mucous up the respiratory system and prevents inhalation into alveoli
 3. Normal bacterial flora
 - a. In GI and GU systems, competition between colonies of microorganisms for nutrients and space helps to prevent proliferation of pathogenic organisms
 - b. Create environmental conditions that are not conducive to pathogens
 - c. Stomach acids may destroy some microorganisms or deactivate their toxic products
 4. GI and GU systems also facilitate elimination of pathogens via feces and urine
 5. Inflammatory response
 - a. Local reaction to cellular injury
 - b. Injury may be physical, thermal, or chemical, or result from invasion by microorganisms
 - c. Like the immune response, the inflammatory response may initiate destruction of the body's own tissue if it overreacts, the so-called autoinflammatory or autoimmune response
- B. The immune system - an overview**
1. White blood cells are the backbone of the immune system
 - a. Humoral immunity component
 - (1) Time-consuming response
 - (2) Specialized white blood cells, called B-cells, eventually differentiate into

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- antibodies
 - b. Cell-mediated immunity component
 - (1) Time-consuming response
 - (2) Specialized white blood cells, called T-cells, that coordinate the activity of other components of the immune system to deal with foreign material
 - (3) Helper T-cells
 - (4) Suppressor T-cells
 - (5) Killer T-cells
 - (6) Inflammatory T-cells
 - c. Nonspecific effector cells without a specialized function
 - (1) Monocytes
 - (2) Neutrophils
 - (3) Eosinophils
 - (4) Basophils
 - (5) NK or natural killer cells
- 2. Reticuloendothelial system (RES)
 - a. Composed of immune cells in the spleen, lymph nodes, liver, bone marrow, lungs, and intestines
 - b. RES works in conjunction with the lymphatic system to dispose of “garbage” material that results from immune system attack of intruders
 - c. RES structures serve as sites where mature B- and T-cells are stored until the immune system is activated by presence of intruders
- 3. Complement system
 - a. Part of the immune system that can recognize and kill invaders on first sight
 - b. Doesn't take time to mobilize specialized responses like the humoral and cell-mediated components of white blood cells

C. Specific immune system defenses

- 1. Humoral immunity
- 2. Cell-mediated immunity
- 3. Complement
 - a. Necessary because
 - (1) Humoral and cell-mediated immunity processes are time-consuming
 - (2) Both cell-mediated and humoral processes depend on previous exposure

- A. Components of a healthcare agency's exposure plan
 1. Health maintenance and surveillance
 2. Appointing a Designated Officer (DO) to serve as the liaison between the agency and community health agencies involved in monitoring/ response to communicable diseases
 3. Identification of job classifications, and in some cases, specific tasks where possibility exists for exposure to bloodborne pathogens
 4. A schedule of when and how the provisions of bloodborne pathogen standards will be implemented, to include
 - a. Engineering and work practice controls
 - b. Personal protective equipment
 - c. Baseline employee evaluations, immunizations, and follow up
 - d. Training of employees
 5. Personal protective equipment (PPE)
 - a. Includes, but is not limited to gowns, gloves, face shields, masks, protective

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- eyewear, aprons, and similar items
 - b. Considered appropriate only when they do not allow blood or other potentially infectious body fluids to reach the emergency responder's work clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use
 - c. Emergency responders may decide to not wear protective clothing for short periods of time when it interferes with patient care
- 6. Body substance isolation
 - a. Standard precautions are more inclusive than BSI
 - b. BSI is more inclusive than universal
- 7. Procedures for evaluating the circumstances of an exposure and postexposure counselling, to include rights to know of emergency response employees exposed to patients with communicable diseases (per Ryan White Act)
- 8. Interfacing with, and notification of, local health authorities, state and federal agencies
- 9. Personal, building, vehicular, and equipment disinfection and storage
- 10. HazComm education for employees regarding disinfection agents
- 11. After-action analysis of agency response
- 12. Correct disposal of needles into containers which meet specific criteria of being rigid, puncture resistant, leak proof, closeable, and have the bio-hazard label
- 13. Correct handling of body-fluid tinged linens and supplies used in patient care
- 14. Identification of agency and/ or contracted personnel for counselling, authorization of acute medical care, and documentation

B. Individual responsibilities

- 1. Develop a proactive attitude relative to infection control
- 2. Maintenance of personal hygiene and prevention of offensive body odors (aesthetics of patient care)
- 3. Attention to wounds and maintenance of integument (external barrier to infection)
- 4. Effective hand washing after every patient contact with warm water and antiseptic cleanser or waterless antiseptic cleanser when potable water is not available
- 5. Removal or disposal of work garments when leaving work station/ site; do not expose others to contaminated garments
- 6. Handling uniforms in accordance with their her agency's definition of PPE
- 7. Proper handling and laundering of work clothes soiled with body fluids, with consideration for bathing/ showering after work shift, and before returning home
- 8. Preparing food and eating in appropriate areas
- 9. Maintenance of general physiological and psychological health to prevent distress, which can immunocompromise a healthy individual
- 10. Correct disposal of needles and sharps into appropriate containers
- 11. Correct disposal of body-fluid tinged linens and supplies used in patient care
- 12. Become aware of, and avoid tendencies to wipe face and/ or rub eyes, nose, mouth with gloved hands
- 13. Knowledge of general classifications of exposure since the type of exposure will determine the extent of the infection control measures applied to the health care worker

- Suspecting infectious diseases
- Acknowledge visceral or intuitive hunches that the dispatched call may involve an infectious disease
- Gloves are worn according to the task to be performed (OSHA and CDC recommendations)
- Protective eye wear

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- E. Patient assessment
 - 1. Body substance isolation
 - 2. Focused history and physical
 - a. History of present illness
 - (1) Onset - gradual or sudden
 - (2) Fever
 - (3) Antipyretic usage (ASA, APAP)
 - (4) Neck pain or rigidity
 - (5) Difficulty swallowing, secretions
 - (6) How did the most bothersome symptom change over time
 - b. Past medical history
 - (1) Chronic infections, inflammation
 - (2) Use of steroids, antibiotics
 - (3) Organ transplant and associated medicines
 - (4) Diabetes or other endocrine disorders
 - (5) COPD or respiratory complications
 - 3. Detailed history and physical
 - a. Assess skin for temperature, hydration, color (jaundice), mottling, rashes, and petechiae
 - b. Assess sclera for icterus
 - c. Assess patient reaction to neck flexion
 - d. Assess for lymphadenopathy in the neck
 - e. Assess breath sounds for consolidation
 - f. Assess for hepatomegaly, RUQ tenderness
 - g. Assess digits and extremities for purulent lesions
- F. Upon disposition of the patient, dispose of supplies, especially sharps, appropriately, bag linen, disinfect ambulance and patient care equipment
 - 1. Reprocessing methods for EMS durable medical equipment
 - a. Sterilization
 - b. High-level disinfection
 - c. Intermediate-level disinfection
 - d. Low-level disinfection

- A. Causative agent - human immunodeficiency virus (types 1 and 2), referred to as HIV-1 and HIV-2, retroviruses
 - 1. Both types are serologically and geographically distinct, but share similar epidemiological characteristics
 - 2. HIV-1 is far more pathogenic than HIV-2, and most cases worldwide and in the U.S. are of HIV-1, Group M
 - a. The first case in the U.S. of an HIV-1, Group O infection was identified in the U.S. in June of 1996 (MMWR Synopsis, July 5, 1996)
 - (1) HIV-antibody tests in U.S. detect HIV-1, Group M with 99% accuracy, and 50-90% for HIV-1, Group O
 - (2) Increasing sensitivity to Group O would be most important for blood donor screening
 - 3. HIV-2 seems to be more restricted to W. Africa
- B. Body systems affected and potential secondary complications - generally related to opportunistic infections that arise as immune system compromise develops
 - 1. Initial case definition was established by CDC in 1982

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2. In 1987 and 1993, case definition was expanded to include indicator diseases extra pulmonary and pulmonary tuberculosis, recurrent pneumonia, wasting syndrome, HIV dementia, and sensory neuropathy
3. Nervous system - toxoplasmosis of CNS
4. Immune system - major site of compromise
5. Respiratory system - pneumocystis carinii pneumonia
6. Integumentary system - Kaposi's sarcoma
7. Modes of transmission
 - a. Sexual contact, sharing of HIV-contaminated needles and syringes, and the infusion of blood and blood products in transmission of HIV are well documented
 - b. Contact with semen, blood, vaginal fluids, and associated tissues is generally accepted as high risk
 - c. 13-30% transmission to infants born to HIV-infected mothers is estimated
 - d. Breastfeeding can result in HIV transmission
 - e. Virus has on occasion been found in saliva, tears, urine, and bronchial secretions, but no known cases have been documented relative to contact with these body fluids
 - f. Vector transmission by biting insects has not been known to occur
 - g. Risk of oral sex is not quantified, but believed to be low
8. Health care workers - probability of infection following a very direct and specific exposure to blood containing the virus is 0.2 - 0.44% (Gerberding, NEJM, 1995)
 - a. Through June of 1995, number of paramedics infected globally reported to be 9 undocumented cases
 - b. A documented case would be defined by
 - (1) A positive source
 - (2) A worker testing positive after the generally recognized incubation phase, with consideration for the window phase
 - c. Health care worker risk increased when
 - (1) The exposure involves a large quantity of blood as when a device is visibly contaminated with blood, when care of the patient involves placing a needle in a vein or artery, and in deep injuries
 - (2) Needle size, type (hollow bore versus suture), and depth of penetration influence volume transferred to skin of health care worker (Mast et. al., J Infec Dis 1992)
 - (3) The exposure involved a source patient with a terminal illness, possibly reflecting a higher dose of HIV in the late course of AIDS
 - d. Risk needs to be understood in terms of how the exposure occurred, and what factors were involved
 - e. Potential may appear to be high, but the probability may actually be quite low
- C. Susceptibility and resistance
 1. Infectiousness may be high during initial period after infection and at end-stage
 2. Race and gender do not appear to be risk factors for susceptibility
 3. Coexisting STDs, especially with ulceration, appear to increase risk
 4. Penile foreskin may increase susceptibility
 5. No recovered cases have been documented
- D. Signs and symptoms
 1. For out-of-hospital workers, HIV-infected patients generally relay that information to health care providers
 2. Within 4 -6 weeks after infection, infected people present with a mononucleosis-like illness which includes fever, sore throat, lymphadenopathy, splenomegaly, and fatigue

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- lasting for a week or two
- 3. Infected people often are asymptomatic for months or years, but may test positive
- 4. Clinical manifestations of opportunistic and neurologic symptoms then appear gradually, often with seemingly benign symptoms similar to the initial mononucleosis-like illness
- E. Patient management and personal protective measures
 - 1. Out-of-hospital care - supportive
 - 2. Isolation is unnecessary, ineffective and unjustified
 - 3. Body substance isolation (including gloves being worn according to the task being performed)
 - 4. Effective handwashing
 - 5. Use of eye protection, masks and gowns are highly recommended in situations where exposures to large volume of body fluids is possible
 - 6. Care in use of diagnostic and therapeutic equipment and supplies is mandatory, especially with sharps
 - 7. Disinfection of diagnostic/ therapeutic equipment and supplies is mandatory
 - 8. Early diagnosis of infection, treatment, and counselling for health care providers, as part of a comprehensive exposure control plan, is mandatory
- F. No immunization yet exists for HIV infection

- A. Causative agent - hepatitis A virus
- B. Body systems affected and potential secondary complications
 - 1. Many infections are asymptomatic
 - 2. Liver may be affected
 - a. Often occurs without jaundice, especially in children
 - b. Only recognizable by liver function studies
- C. Routes of transmission
 - 1. Found in the stool of persons with hepatitis A
 - 2. Contaminated water, ice or food
 - 3. Sexual and household contact can spread the virus
 - 4. Can survive on unwashed hands for 4 hours
- D. Susceptibility and resistance
 - 1. No clearly defined populations at increased risk
 - 2. 75% of persons infected with hepatitis A virus have symptoms
 - 3. In developing nations where sanitation is poor, infection and subsequent immunity is common; travelers from developed countries are therefore susceptible
 - 4. In developed nations, often associated with day care in which diaper changing occurs
- E. Signs and symptoms
 - 1. Onset is abrupt with fever, weakness, anorexia, abdominal discomfort, nausea, and darkening of the urine, sometimes followed within a few days by jaundice/ icterus
 - 2. Mild severity lasting 2-6 weeks
 - 3. Rarely serious
- F. Patient management and protective measures
 - 1. Care is supportive for maintenance of fluid status and prevention of shock
 - 2. A person is most infectious during the first week of symptoms
 - 3. BSI and gloves, combined with attention to not placing gloved hand close to the mouth, are mandatory
 - 4. Hand washing after each patient contact and safe/ effective disposal of items contaminated with feces
- G. Immunization

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1. An inactivated hepatitis A vaccine is available
2. Prophylactic IG may be administered within two weeks after exposure to hepatitis A
3. Persons traveling to Africa, the Middle East, Central and South America, and Asia should be immunized
4. FEMA team personnel should be offered vaccine if they travel out of the United States

- A. Causative agent - hepatitis B virus
- B. Organ affected and potential secondary complication - liver necrosis
- C. Routes of transmission
 1. Blood, semen, vaginal fluids, and saliva are infectious
 2. Transmission has been known to occur during transfusion of blood and blood products, dialysis, needle and syringe sharing in IV drug use, tattooing, sexual contact, and acupuncture, and communally-used razors and toothbrushes
 3. HBV is stable on environmental surfaces with dried, visible blood for > 7 days
 4. Infection has also been demonstrated in household contacts in toddler-aged children who live in a family with members who carry certain HB antigens
 5. Transmission by biting insects and the fecal-oral route of hepatitis B has not been demonstrated
- D. Susceptibility and resistance
 1. No populations appear to be at increased risk for infection
 2. Protective immunity develops if the HBV antigen disappears and HBV antibody is demonstrated in serum
 3. Probability of infection following exposure to blood containing the virus is 1.9 - 40%
- E. Signs and symptoms
 1. Within 2-3 months, infected persons gradually develop non-specific symptoms such as anorexia, nausea and vomiting, fever, joint pain, generalized rashes, sometimes progressing to jaundice
 2. Risk of developing chronic infection varies inversely with age
 3. 1% of hospitalized patients develop a full-blown liver crisis and die, with the mortality increasing > 40 years of age
 4. 5-10% of infected individuals become asymptomatic carriers
- F. Patient management and protective measures
 1. Out-of-hospital care is supportive measures
 2. Body substance isolation
 3. Effective hand washing
 4. Care in use of diagnostic and therapeutic equipment and supplies is mandatory
 5. Careful handling of sharps
 6. High-level disinfection of diagnostic/ therapeutic equipment, especially laryngoscopy blades, is mandatory
- G. Immunization
 1. Recombinant vaccines (Recombivax HB® and Engerix B®) are as effective as the previously available Heptavax® (derived from plasma) and do not carry the theoretical risk of HIV transmission or other viral illnesses
 2. Vaccines are given as initial, 1-month, and 6-month doses, and provide long lasting immunity 95-98% of the time
 3. Adverse reactions of vaccine include local injection site pain 15-20%, and rare fever, rash, or muscle pain (<3%)

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- A. Causative organism - hepatitis C virus
- B. Organ affected - liver
- C. Routes of transmission
 1. Health care workers - 2.7 to 10% probability of infection when exposed to blood containing the virus
 2. Transmission by household and sexual contact appear to be low
 3. Transmission cannot occur from food and water
- D. Susceptibility and resistance
 1. General susceptibility
 2. Degree of immunity following infection is unknown, but a high percentage of infected individuals become carriers
- E. Signs and symptoms
 1. Same as for hepatitis B, but with less progression to jaundice
 2. Chronic liver disease with elevated enzyme profile is common, with 80-85% developing chronic liver disease
 3. Apparent association between HCV infection and liver cell cancer
- F. Patient management and protective measures
 1. Same as for hepatitis B
 2. BSI
 3. Effective hand washing
 4. Alpha-interferon (an experimental treatment) has been shown to be effective in 20% of cases
- G. Immunization and control measures
 1. Prophylactic administration of IG is not supported by current data
 2. Post exposure testing is important
 3. Blood bank operations - blood with elevated liver enzymes and antibody against HCV is not banked in most U.S. centers

- A. Causative agent
 1. Hepatitis D - the delta virus is not complete, but infects a cell with other hepatitis virus
 2. Hepatitis E (not bloodborne; is spread like Hepatitis A)
 3. Hepatitis G - newly identified hepatitis viruses
- B. Organ affected - liver
- C. Routes of transmission - similar to HBV
- D. Susceptibility and resistance
 1. Hepatitis D - when the virus becomes active in people infected with hepatitis B virus, the resulting disease becomes extremely pathogenic
 2. Major epidemics have been documented in young adults, even in areas where enteric viruses are endemic (underdeveloped nations)
 3. Women in third trimester of pregnancy are particularly susceptible to fulminating liver disease
 4. Resistance unknown
 5. Presence of epidemics in young adults (see D1 above), who should have immunity, is paradoxical
- E. Signs and symptoms
 1. Onset is abrupt, with signs and symptoms resembling HBV infection
 2. Always associated with HBV infection
 3. Often (25-50% of cases in U.S. and Europe) mistaken for HBV infection
- F. Patient management and protective measures

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1. BSI
2. Effective hand washing
3. Particular attention to be paid to having clean potable water and disinfection procedures after exposure to flood waters

G. Immunization and control measures

1. Hepatitis B vaccine can indirectly prevent Hepatitis D, but has no effect on Hepatitis E
2. If you are effectively vaccinated against HBV, with a documented protective titer, then you are vaccinated against HDV

- A. Causative agent - mycobacterium tuberculosis
- B. Body systems affected and secondary complications
 1. Initially affects respiratory system, including the larynx, which is a highly contagious form
 2. Left untreated, tuberculosis can spread to other organ systems and cause secondary and tertiary complications
- C. Routes of transmission
 1. Exposure to causative agent in airborne droplet nuclei
 2. Prolonged close exposure to a person with active TB
 3. Direct invasion through mucous membranes or breaks in skin are known, but not common
 4. Reservoirs include some primates, cattle, badgers, and swine
- D. Susceptibility and resistance
 1. Period of incubation is 4-12 weeks (CDC)
 2. Period for development of clinical disease is 6-12 months after infection
 3. Risk of developing disease is highest in children < 3, lowest in later childhood, and high among adolescents, young adults, and aged
 4. High in immunocompromised patients, e.g. HIV-infected, underweight, and undernourished
 5. Incidence of reactivation of latent infections (seen in geriatric patients) implies that immune system is incapable of dealing with complex M. tuberculosis infection
- E. Signs and symptoms
 1. First infection of mycobacterium tuberculosis is called primary tuberculosis and is usually a subclinical infection
 - a. Cell-mediated immunity walls off the bacteria and suppresses them
 - b. These bacteria lie dormant, but can reactivate into secondary tuberculosis
 - c. Symptomatic primary tuberculosis is rare and more commonly occurs in elderly, children, and immunocompromised
 2. Most common site of secondary or reactivation TB is in the apices of the lungs (M. tuberculosis is an aerobic organism and the oxygen tension is highest in the apices)
 - a. Patients present with chronic productive/ non-productive cough (persistent for 2-3 weeks), low-grade fevers, night sweats, weight loss, and symptoms related to the organ system involved
 - b. Hemoptysis often accompanies lung infection
 - c. Other organ systems
 - (1) Cardiovascular
 - (a) Pericardial effusions may develop
 - (b) Lymphatics - cervical nodes are usually involved
 - (2) Skeletal
 - (a) Generally affects the thoracic and lumbar spine, destroying intervertebral discs and adjacent vertebral bodies

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- (b) Chronic arthritis of one joint is common
 - (3) CNS - TB causes a subacute meningitis and forms granulomas in the brain
 - (4) Systemic - miliary tuberculosis
- F. Patient care and protective measures
 - 1. Identification and early intervention are key
 - 2. Related to public education and routine evaluation of health care workers consisting of
 - a. PPD (Purified Protein Derivative)
 - b. Chest x-ray (CXR)
 - c. Sputum acid-fast stain and culture of bacteria
 - d. PCR testing provides a diagnosis in 6 hours with no need to wait for cultures
 - 3. EMS workers should remember that TB infection is communicable with prolonged exposures to infected individuals who discharge droplets into the air by coughing
 - 4. EMS workers should be alert to those populations that have significant prevalence of active TB in their jurisdictions (as reported by local public health authorities) and utilize NIOSH approved particulate filter respirators
 - a. Post-call disinfection should be at appropriate levels
 - 5. Drug therapy
 - a. Prophylactic (INH)
 - (1) Recommended routinely for persons < 35, who are PPD positive skin test boosters
 - (2) Not routinely recommended for persons > 35 due to hepatic complications with INH unless one or more of the following is present
 - (a) Recent infection as evidenced by PPD skin test conversion
 - (b) Close or household contact with a current case
 - (c) Abnormal CXR
 - (d) Prolonged therapy with immunosuppressive drugs
 - (e) HIV or other immunosuppressive disease
 - (3) Avoid alcohol when taking INH
 - (4) Side effects include paresthesias, seizures (toxic reaction), orthostatic hypotension, nausea and vomiting, hepatitis, and hypersensitivity
 - b. Therapeutic
 - (1) For pulmonary TB, positive to negative sputum conversion and results of culture are usually available 3-8 weeks after initiation of therapy
 - (2) In most areas of the U.S., a combination of drugs
 - (a) Isoniazid
 - (b) Rifampin
 - (c) Pyrazinamide
 - (d) Ethambutol
 - (e) Streptomycin may be used after antibiotic sensitivity tests
- G. EMS workers must be aware that the greatest danger from TB is from multidrug resistant strains of the bacterium, which can render antibiotics ineffective, and prolong the infectiousness of a patient

A. Causative organism

1. *Neisseria meningitidis*, meningococcus
2. Other organisms are known to cause meningitis, but *N. meningitidis* is specifically identified at the beginning of this section because, like *M. tuberculosis*, it is an airborne pathogen

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- B. Tissues affected
 - 1. Colonize the lining of the throat and spread easily through respiratory secretions
 - 2. Estimated that 2 -10% of the population may carry meningococci at any one time, but are prevented from invading the meninges, and gaining access to the rich culture medium of the CSF by the throat's epithelial lining
- C. Modes of transmission
 - 1. Direct contact with a patient's secretions during intubation, suctioning, CPR, etc.
 - 2. Prolonged, direct contact
 - a. Respiratory droplets from nose and throat of affected individuals
- D. Susceptibility and resistance
 - 1. Almost every human has been a carrier at some point in their life
 - 2. Conversion from carrier to clinical disease is rare in developed countries (3 in 100,000 in the U.S.), and occurs in clusters in developing nations
 - a. Risk factors for an epidemic affect an entire population, not just scattered individuals
 - b. General level of immunity in these populations, called herd immunity, might change in the population over time
 - c. One theory - non-pathogenic *Neisseria lactamica*, which is a relative of *N. meningitidis*, causes antibody production which may also be protective against *N. meningitidis*
 - d. Population studies in the meningitis belt in Africa have yielded seasonal variations in meningitis epidemics, implying that environmental factors are involved
 - e. Researchers in England and France have noted that illness is most prevalent in midwinter months, when cold viruses are common (noted in spring and fall in high schools and colleges)
- E. Signs and symptoms
 - 1. Onset is rapid and typical symptoms include fever, chills, joint pain, neck stiffness or nuchal rigidity (pronounced on flexion), petechial rash, projectile vomiting, and headache
 - 2. Roughly 10% of patients may develop septic shock (Waterhouse-Friderichsen Syndrome)
 - a. Acute adrenal insufficiency, DIC and coma may result
 - b. Death can ensue in 6-8 hours
 - 3. Pediatric patients - infants 6 months to 2 years are especially susceptible; maternal antibodies protect neonates to 6 months
 - a. Infants display nonspecific signs such as fever, vomiting, irritability, and lethargy
 - b. Bulging of an open anterior fontanelle may be found in neonates
 - c. In older children, positive Kernig's and Brudzinski's signs may be found
- F. Patient management and protective measures
 - 1. Protective measures should include BSI with surgical masks applied to patients displaying suggestive signs/ symptoms
 - 2. Effective prophylactic drug treatments of intimate contacts are available, and include rifampin, minocycline, ciprofloxacin, ceftriaxone, and spiramycin to prevent infection from the patient's nasal discharges
- G. Immunization and control measures
 - 1. Vaccines are effective, especially for older children and adults, and have been instrumental in preventing outbreaks among military recruits in the U.S., which, prior to 1971, was a common occurrence
 - 2. Vaccines have been developed which are effective against the A, C, Y, and W-135 strains of meningococcus

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3. Outbreaks in the U.S. have primarily been of the A, B, and C strains
 4. Duration of protection is limited in children aged 1-3
 - a. An effective vaccine has not been developed for the B strain since it is not known to generate a strong enough antibody response
 - b. Routine vaccination is not recommended
 - c. Should be considered in a discrete population exposed to a serogroup for which an effective vaccine exists, i.e. not serogroup B
 5. Post EMS exposure activities should be addressed as part of an agency Exposure Control Plan
- H. Other infectious agents known to cause meningitis
1. Streptococcus pneumoniae (bacteria)
 - a. Second most common cause of meningitis in adults
 - b. Most common cause of pneumonia in adults
 - c. Most common cause of otitis media in children
 - d. Spread by droplets, prolonged personal contact, or contact with linen soiled with respiratory discharges
 - e. Episodic contact by EMS personnel should rarely result in infection, however, BSI applies since causative organism is never known by EMS
 - f. Protective measures for EMS workers
 2. Hemophilus influenza type B (bacteria)
 - a. Gram-negative rods
 - b. Mode of transmission same as for N. meningitidis (therefore, same considerations for BSI)
 - c. Prior to introduction of vaccination for children in 1981, it was the leading cause of meningitis in children aged 6 months to 3 years
 - d. Although treatment with antibiotics is very effective, over 50% of all infected children will have long-term neurologic sequelae
 - e. Also implicated in pediatric epiglottitis, septic arthritis, and generalized sepsis
 3. Viruses (causes syndromes sometimes referred to as aseptic meningitis)
 - a. There are a variety of viruses known to cause meningeal signs and symptoms
 - (1) Most associated with other specific diseases
 - (2) Seasonal variations may occur
 - b. Not considered communicable

XIV. Pneumonia

- A. Etiologic agents/ causative organisms
 - 1. Bacterial (*Streptococcus pneumoniae*, *Mycoplasma pneumoniae*, *Staphylococcus aureus*, *H. influenzae*, *Klebsiella pneumoniae*, *Moraxella catarrhalis*, *Legionella*)
 - 2. Viral
 - 3. Fungal
- B. Systems affected
 - 1. Respiratory - pneumonia
 - 2. CNS - meningitis
 - 3. ENT - otitis, pharyngitis media
- C. Routes of transmission
 - 1. Droplet spread
 - 2. Direct contact
 - 3. Contact with linens soiled by respiratory secretions
- D. Susceptibility and resistance
 - 1. Susceptibility is increased by processes that adversely affect the status of respiratory

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- tissues, i.e., pulmonary edema, influenza, exposure to inhaled toxins, chronic lung disease, and aspiration of any form (post alcohol ingestion, near-drowning, gastric distension from BVM ventilation)
- 2. Geriatric patients are highly susceptible
- 3. Pediatric patients with low birth weight and malnourishment are very susceptible
- 4. Patients with the following diseases have increased susceptibility
 - a. Sick cell disease
 - b. Cardiovascular disease
 - c. Anatomic or functional asplenia
 - d. Diabetes mellitus
 - e. Chronic renal failure or other kidney disease
 - f. HIV infection
 - g. Organ transplantation
 - h. Multiple myeloma, lymphoma, Hodgkin's disease
- E. Signs and symptoms
 - 1. Onset of pneumonia may be sudden with chills, high-grade fevers, chest pain with respirations, and dyspnea
 - 2. In children, fever, tachypnea, and chest retractions are ominous signs
 - 3. Purulent alveolar exudates may develop in one or more lobes
 - 4. Patient may cough up yellow-green phlegm
- F. Patient management and protective measures
 - 1. Several effective antibiotics exist to treat bacterial pneumonia
 - 2. Multi-drug resistant strains have been reported
 - 3. Patient isolation generally not warranted except in clinical facilities where patient with a resistant strain may be in contact with other patients who have increased susceptibility to infection
 - 4. Protective measures for EMS workers
- G. Immunization
 - 1. Vaccine exists for some causes of pneumonia
 - 2. Immunization of contacts, i.e., exposed EMS workers, is generally not recommended

- A. Causative organism - Clostridium tetani
- B. System affected - musculoskeletal
- C. Mode of transmission
 - 1. Tetanus spores introduced into the body through wounds, burns, or other disruptions in the integument
 - 2. Puncture wounds introducing soil, street dust, and animal or human feces
 - 3. Dead or necrotic tissue is an indication of a favorable environment for C. tetani
 - 4. Infection has often developed in wounds considered too trivial for medical consultation
- D. Susceptibility and resistance
 - 1. Susceptibility is general, which is why tetanus immunization is recommended for the general population
 - 2. Subsequent recovery from infection does not confer immunity
- E. Signs and symptoms
 - 1. Muscular tetany
 - 2. Painful contractions, particularly of the masseter (trismus or lockjaw) and neck muscles, secondarily of trunk muscles
 - 3. In pediatrics, abdominal rigidity may be the first sign
 - 4. Painful spasms often occur, with a characteristic facial contortion known as risus

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- sardonicus, a grotesque grinning expression
- 5. Tetanus can lead to respiratory failure
- F. Patient management and protective measures
 - 1. Temporary passive immunity is provided by post-exposure administration of tetanus immune globulin or tetanus antitoxin (equine origin)
 - 2. Generally followed by active tetanus immunization with a booster
 - a. EMS workers - keep immunizations up to date
 - 3. EMS providers, when dealing with patients who have wounds, counsel them and document warnings about post-injury tetanus prophylaxis and effective debriding of tissue at the site of the wound
 - a. Ask patient about immunization status
- G. Immunization
 - 1. Generally begun during childhood
 - 2. Booster before entry into elementary school
 - 3. Booster every ten years thereafter
 - 4. Administered as a DPT, with immunization against diphtheria (laryngitis, pharyngitis with discharges) and pertussis (whooping cough)
 - 5. Booster administered every 10 years confers effective active immunity

- A. Causative organism - rabies virus of the genus *Lyssavirus*
- B. System affected - nervous system
- C. Route of transmission
 1. Virus-laden saliva from a bite or scratch of an infected animal
 2. Transmission from person-to-person is theoretically possible, but has never been documented
 3. Airborne spread has been documented in bat caves, but these are rare
 4. Hawaii is the only area in the U.S. that is rabies free
 5. Transmission from vampire bats to domestic animals is common in Latin America, less common in U.S.
 6. In U.S., wildlife rabies is common in skunks, raccoons, bats, foxes, dogs, wolves, jackals, mongoose, and coyotes
- D. Susceptibility and resistance
 1. Mammals are highly susceptible
 2. Humans are especially susceptible when bitten by infected animals
 3. Incubation period is usually 3-8 weeks, as short as 9 days (rare), and as long as 7 years
 4. Infectivity governed by severity of the wound, richness of nerve supply close to the wound, distance to CNS, amount and strain of virus, degree of protective clothing, and other factors
- E. Signs and symptoms
 1. Onset is heralded by a sense of apprehension, headache, fever, malaise, and poorly-defined sensory changes
 2. Disease progresses to weakness or paralysis, spasm of swallowing muscles (causing hydrophobia or fear of water), delirium, and convulsions
 3. Without medical intervention, the disease lasts 2-6 days, often resulting from death due to respiratory failure
- F. Patient management and protective measures
 1. EMS workers - transmission from human patients to health care workers has never been documented
 2. Health care workers should protect themselves with BSI

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3. Prevention of rabies after bite
 - a. Thorough debridement of wound without sutures unless necessary for tissue-support
 - b. Free bleeding and drainage is necessary
 - c. Vigorously clean the wound with soap and water (saliva is a risk from the infected animal) and irrigate with 70% alcohol
 - d. Administration of human rabies immune globulin
 - e. Immunization with Human Diploid Cell Rabies Vaccine, or Rabies Vaccine
 - f. Tetanus prophylaxis and antibiotics as needed
- G. Immunization and control measures
 1. Immunization of contacts with open wounds or exposure of mucous membranes to saliva should receive treatment
 2. Immunization should be directed towards individuals with high probability of contacting animal reservoirs (animal care workers, animal shelter personnel, outdoor workers)

XVII. Viral diseases of childhood

A. Chickenpox

1. Causative organism - varicella-zoster virus, a member of the Herpesvirus group
2. System affected - primarily integumentary
 - a. Herpes zoster (shingles) is a local manifestation of reactivation of latent viral infection of dorsal root ganglia and displays distribution along nerve fibers on the skin
3. Mode of transmission - mainly airborne
 - a. Exposure to linen tainted with vesicle or mucous membrane discharges of infected persons has been implicated
4. Susceptibility and resistance - general
 - a. Incubation period - 10 to 21 days
 - b. Most people develop immunity for life after recovery
 - c. More severe form of disease in adults
5. Signs and symptoms
 - a. Begins with respiratory symptoms, malaise and low-grade fever
 - b. Rash begins as small red spots that become raised blisters on a red base These fluid-filled vesicles eventually collapse and dry into scabs
 - (1) Rash is profuse on trunk, and less so on extremities and scalp
6. Patient management and protective measures
 - a. Isolation of children from school, medical offices, emergency departments, and public places until all lesions are crusted and dry
 - b. Antiviral drugs exist that shortens the duration of symptoms and pain in the older patient
 - c. EMS workers should observe BSI, pay attention to handling soiled linen, and hand washing
 - d. EMS workers who have not had chickenpox should inquire with their agency about receiving the chickenpox vaccine
 - (1) Data indicate adult antibody production in 82% after one dose, and 92% after two doses
 - (2) Vaccine should not be given to individuals receiving high doses of systemic steroids in the past month
 - (3) 5% of patients develop rash and some develop frank chickenpox, which is very debilitating in adults
 - e. VZIG (Varicella Zoster immune globulin) is recommended for pregnant women

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with a substantial exposure (household contact, close indoor contact > 1 hour, or prolonged direct face-to-face contact with infected person) to chickenpox with no history of previous exposure to chickenpox

- b. Effective hand washing
 - c. All EMS workers, especially females, should be screened for immunity to rubella, and be effectively immunized before working
 - d. Unimmunized pregnant females exposed to rubella during the first trimester are at risk for abnormal fetal development
 - e. There is no specific treatment for rubella
- 7. Immunization
 - a. Immunization is known to be 98-99% effective
 - b. Frequently combined with mumps and measles vaccine
 - c. Immunization is not recommended for pregnant women; possibility of vaccine causing developmental defects is theoretical only

D. Measles (rubeola, hard measles)

- 1. Causative organism - measles virus, of the genus Morbilli virus, family Paramyxoviridae
- 2. Systems, organs, tissues affected - respiratory, CNS, pharynx, eyes, systemic
- 3. Mode of transmission - nasopharyngeal air droplets and direct contact
- 4. Susceptibility and resistance - general
 - a. Period of communicability is before the prodromal period to four days after appearance of the rash
 - b. Immunity acquired after illness is permanent
- 5. Signs and symptoms
 - a. Prodrome - conjunctivitis, swelling of the eyelids, photophobia, high fevers to 105 degrees, hacking cough, and malaise
 - b. A day or 2 before the rash, patients develop small, red-based lesions with blue-white centers in the mouth, called Koplik's spots, sometimes disappearing with the eruption of generalized skin rash
 - c. The rash is red, slightly bumpy (maculopapular) and spreads from the forehead to the face, neck, torso, and hits the feet by the third day
 - d. The rash, which usually lasts for six days, initially appears thicker over the heads and shoulder, clears up, and follows that pattern towards the feet
 - e. Pneumonia, eye damage and myocarditis are all possible sequelae, but the most life-threatening is subacute sclerosing panencephalitis in which a child or adolescent may develop slowly progressing neurological disease with deterioration of mental capacity and coordination
- 6. Patient management and protective measures
 - a. BSI, including mask
 - b. Effective hand washing
 - c. EMS and other health care workers should be effectively immunized to prevent transmission to pediatric patients
 - d. There is no specific treatment
- 7. Immunization
 - a. Effective immunization should be instituted for every person, and is available for combination with other vaccines and/ or toxoids (MMR)
 - b. Immunization in children is believed to confer 99% immunogenicity

E. Pertussis (Whooping cough)

- 1. Causative organism - Bordetella pertussis
- 2. What affected - oropharynx
- 3. Mode of transmission - direct contact with discharges mucous membranes contained in airborne droplets
- 4. Susceptibility and resistance
 - a. General susceptibility

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- b. Infection generally confers immunity
 - c. Subsequent attacks after immunization in older children and adults in U.S. indicates that immunity may wane over time
5. Signs and symptoms
 - a. Insidious onset of cough which becomes paroxysmal in 1-2 weeks, and lasts 1-2 months
 - b. Paroxysms are violent, sometimes without an intervening inhalation, causing the crowing or high-pitched inspiratory whoop and end with expulsion of clear mucous and vomiting
 - c. Whoop often not present in infants < 6 months and adults
6. Patient management and protective measures
 - a. EMS and other health care workers should be cautious about handling linens, supplies and equipment on patients, both pediatric and adult, with a recent onset of paroxysmal cough; observe BSI and mask patient with surgical mask
 - b. Communicable period is thought to be greatest before the onset of paroxysmal, violent coughing
 - c. Incubation period - 6 to 20 days
 - d. Erythromycin is known to decrease the period of communicability, but can only reduce symptoms if given during the incubation period, before the onset of paroxysmal coughing
7. Immunization
 - a. Generally given with tetanus and diphtheria vaccines (DTP)
 - b. Booster doses are recommended

A. Influenza

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- c. Contact with soiled linen and objects that come into contact with the patient's respiratory mucous membranes (e.g., thermometers, inhalation supplies) should be handled with appropriate caution

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- herpetic whitlow
- c. Treatment with acyclovir (Zovirax®) is of benefit when used topically, IV, or orally
- 7. No immunization available
- D. Other viral respiratory diseases
- 1. Acute afebrile viral respiratory disease (excluding influenza)
- a. Disease entities
- (1) Viral rhinitis, pharyngitis (common cold or URI), laryngitis
- (2) Lower respiratory tract (below the epiglottis) - croup, bronchitis, bronchiolitis
- b. Can cause bacterial complications, which has contributed to the non-judicious use of antibiotics and emergence of multi-drug resistant strains of bacteria
- c. Children are most adversely affected
- d. Large number of viruses involved, but bacterial infections (legionellosis, Q fever, Group A Streptococcus, mycoplasmal pneumonia), for which specific treatments may be available, must be considered
- 2. Acute febrile respiratory disease
- a. Pharyngitis, tonsillitis, laryngitis, croup, bronchitis, bronchiolitis, pneumonitis, with fever
- b. Caused by
- (1) Parainfluenza virus, types 1, 2, 3
- (a) Major cause of croup and one of the major viral agents responsible for bronchiolitis
- (2) Respiratory syncytial virus (RSV)
- (a) Major viral respiratory pathogen of infants < 2
- (b) Usually spread from November - April
- (c) RespiGam® (RSV immune globulin) is a consideration
- 3. BSI when handling patients, with consideration for applying surgical mask to patients

XIX. Sexually transmitted diseases

A. Syphilis

1. Causative organism - *Treponema pallidum*, a spirochete
2. What affected - skin, CNS, eyes, joints & skeletal system, kidneys, cardiovascular
3. Modes of transmission
 - a. By direct contact with exudates from moist, early, obvious or concealed lesions of skin and mucous membranes, or semen, blood, saliva, vaginal discharges
 - b. Via blood transfusion and needlestick injury (low risk)
4. Susceptibility and resistance
 - a. Susceptibility is general, and it is estimated that 30% of exposures result in infection
 - b. Infection results in development of gradual immunity, however, aggressive treatment of primary and secondary stages interferes with natural antibody development
5. Signs and symptoms - occurs in 4 stages
 - a. Primary stage - painless lesion develops at point of entry called a chancre, 3-6 weeks after the initial contact
 - b. Secondary stage - bacteremia stage begins approximately 6 weeks after the chancre has healed
 - (1) Rash (small, red, flat lesions) on palms and soles of feet, lasts about 6 weeks
 - (2) Condyloma latum - painless, wart-like lesion found in moist, warm sites

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- like the inguinal area; this lesion is extremely infectious, lasts about 6 weeks
 - (3) Skin infection in areas of hair growth results in bald spots and/ or loss of eyebrows
 - (4) CNS, eyes, bone and joints, or kidneys may become involved
- c. Third stage - latent syphilis
 - (1) 25% may relapse and develop secondary stage symptoms again
 - (2) After 4 years, there are generally no more relapses
 - (3) 33% of patients will progress to tertiary syphilis, the rest will remain asymptomatic
- d. Tertiary syphilis
 - (1) Granulomatous lesions called gummas found on skin and bones; skin gummas are painless with sharp borders; bone lesions cause a deep, gnawing pain
 - (2) Cardiovascular syphilis
 - (a) Occurs 10 years after primary infection
 - (b) Generally results in dissecting aneurysm of ascending aorta or aortic arch; antibiotics do not reverse this disease process
 - (3) Neurosyphilis
 - (a) Asymptomatic
 - (b) Develop meningitis
 - (c) Develop spinal cord disease that results in loss of reflexes and loss of pain and temperature sensation
 - (4) Spirochetes attack cerebral blood vessels and cause a cerebrovascular occlusion
 - (a) Develop general paresis (of the insane) - progressive disease of cerebral cells leading to mental deterioration and psychiatric symptoms

6. Patient management and protective measures

- a. EMS personnel should observe BSI so as to avoid contact with syphilis lesions
- b. Continuation of BSI during equipment cleaning is highly recommended, with effective hand washing
- c. T pallidum is extremely fragile and is easily killed by heat, drying, or soap and water
- d. Treatment is effective with penicillin, erythromycin, and doxycycline

7. No immunization is available

B. Gonorrhea

- 1. Causative organism - Neisseria gonorrhoeae
- 2. What affected - genital organs and associated structures
- 3. Mode of transmission - direct contact with exudates of mucous membranes, almost always from unprotected sexual intercourse
- 4. Susceptibility and resistance
 - a. Susceptibility is general
 - b. Antibodies develop after exposure, but only to the specific strains of N. gonorrhoeae that have infected the patient
 - c. Subsequent reinfection by other strains can therefore occur
- 5. Signs and symptoms
 - a. In males
 - (1) An initial inflammation of the urethra, with dysuria and a purulent urinary discharge, sometimes from the urinary meatus in the absence of urine

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- (2) This, left untreated, can progress to an epididymitis, prostatitis, and strictures of the urethra
- b. In females
 - (1) Dysuria and purulent vaginal discharge may occur
 - (2) The majority of females have no pain and minimal urethral discharge
 - (3) Gonococcal infection of the cervix can progress to pelvic inflammatory disease, causing fever, lower abdominal pain, abnormal menstrual bleeding, and cervical motion tenderness upon vaginal exam
 - (4) Menstruation allows the bacteria to spread from the cervix to the upper genital tract, and results in 50% of PID cases occurring within 1 week of the onset of menstruation
 - (5) Females are at increased risk for sterility, ectopic pregnancy, abscesses of the fallopian tubes, ovaries, or peritoneum, and peritonitis after gonococcal infection
- c. In rare instances, a systemic bacteremia can occur
- d. A septic arthritis with fever, pain, and swelling of 1 or 2 joints can occur, which, left untreated, can cause progressive deterioration of the joints

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- D. Herpes simplex virus type 2 (genital herpes)
 - 1. Causative organism - Herpes simplex virus type 2 (HSV 2)
 - 2. What affected - regions, tissues, and structures associated with intimate contact
 - 3. Mode of transmission - sexual activity
 - 4. Susceptibility and resistance - general susceptibility
 - 5. Signs and symptoms
 - a. Males - lesions of the penis, anus, rectum, and/ or mouth depending on sexual practices
 - b. Females - Sometimes asymptomatic; lesions of the cervix, vulva, anus, rectum and mouth depending on sexual practices; recurrent disease generally affects the vulva, buttocks, legs, and perineal skin
 - c. Infants - via the birth canal
 - 6. Patient management and protective measures
 - a. EMS personnel should observe BSI when handling linen, supplies, and equipment used in the care of patients with possibility of infection; this is a negligible risk if the skin is intact; treatment with acyclovir (Zovirax®) is of benefit when used topically, IV, or orally for genital herpes
 - 7. No immunization available

A. Scabies

1. Etiologic agent - *Sarcoptes scabiei*, a mite; Norwegian scabies the most severe variety
2. What affected - skin
3. Modes of transmission
 - a. Direct skin-to-skin contact, including sexual contact
 - b. Bedding is infectious only if it has been in contact with infected person immediately beforehand (last 24 hours)
 - c. Mite can burrow into the skin in 2.5 minutes
4. Susceptibility and host factors
 - a. Susceptibility is general, but people with previous exposure
 - (1) Develop less mites on successive exposures
 - (2) Develop symptoms 1-4 days after exposure, as opposed to 2-6 weeks for people without previous exposure
 - b. Mites are communicable until all mites and eggs are destroyed, normally after one, probably two treatments, spaced one week apart
5. Signs and symptoms
 - a. Intense itching, especially at night, with vesicles, papules, and linear burrows which contain the mites and eggs
 - b. Males - lesions prominent around finger webs, anterior surfaces of wrists and elbows, armpits, belt line, thighs and external genitalia
 - c. Females - lesions prominent on nipples, abdomen, and lower portion of buttocks
 - d. Infants - head, neck, palms, and soles may be involved, and are generally not seen in older adults
 - e. Complications generally due to infection of lesions that are broken from scratching
6. Patient management and protective measures
 - a. EMS personnel should handle patients, underclothing, and home bedding observing BSI, separate bagging of exposed ambulance linen
 - b. Personal - laundering of underwear, clothing, and bed sheets used in the 48 hours prior to treatment in hot cycles of washer/ dryer is of questionable benefit,

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- c. Treatment normally consists of Kwell®, lindane, or other agents selected based on patient age, with specific instructions for concurrent cleansing of linen and clothing; over treatment should be avoided out of concern for toxicity
- d. Family education important relative to use of insecticides and emphasis on environmental issues of washing bedding and clothing

- ## XXI. Lyme disease

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- A. Causative organism - *Borrelia burgdorferi*, a spirochete like the causative organism of syphilis
- B. What affected - skin, CNS, cardiovascular system, joints
- C. Mode of transmission - tick (vector) borne, with reservoirs in mice and deer
- D. Susceptibility and resistance
 - 1. Susceptibility - all persons are susceptible
 - 2. Reinfection has occurred in those treated with antibiotics for early disease, so probably no immunity occurs
- E. Signs and symptoms - stages that, like syphilis, occurs in phases
 - 1. An early localized stage with a painless skin lesion at the site of the bite, called erythema migrans (EM), and a flu-like syndrome with malaise, myalgia, and stiff neck
 - a. EM starts off as a red, flat, round rash which spreads out; the outer border remains bright red, with the center becoming clear, blue, or even necrotic and turn black
 - b. Incubation period until EM - 3 to 32 days post tick exposure
 - 2. Early disseminated stage in which *B. burgdorferi* invades the skin, nervous system, heart, and joints
 - a. Skin - multiple EM lesions
 - b. Nervous system
 - (1) Invades brain, causing meningitis
 - (2) Invades cranial nerves, especially the 7th, and creates a Bell's palsy
 - (3) Invades motor/ sensory nerves and creates a peripheral neuropathy
 - c. Cardiac abnormalities
 - (1) Atrioventricular block
 - (2) Myocarditis and left ventricular dysfunction are less common
 - d. Joint and muscle pain - arthritis can occur 6 months after infection
 - 3. Late stage
 - a. About 10% of untreated patients develop a chronic arthritis that lasts for more than a year, and involves large joints such as the knee
 - b. An encephalopathy can develop characterized by cognitive deficits, depression, and sleep disorders
- F. Patient management and control measures
 - 1. EMS personnel who work, or treat/ transport patients in a wilderness environment, should be vigilant to the presence of ticks on themselves and their patients
 - a. EMS workers should spray the patient compartment of the ambulance with an insecticide that is known to be effective for ticks
 - 2. There is no evidence of natural transmission from person-to-person
 - 3. Effective antibiotic regimens exist for treatment of EM, neurologic abnormalities, and arthritis associated with *B. burgdorferi* infection
- G. No immunization is available

XXII. Gastroenteritis

- A. Causative organisms
1. Rotavirus, Norwalk virus, and many others
 2. Parasites - Protozoa *Giardia lamblia*, *Cryptosporidium parvum*, and *Cyclospora cayetanensis*
 - a. Contracted via fecal-oral transmission, contaminated food and water
 - b. *Cyclosporida* reported to be contracted by swimming in contaminated waters
 3. Bacteria
 - a. *Escherichia coli*
 - b. *Klebsiella pneumoniae*

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- c. Enterobacter
- d. Campylobacter jejuni
- e. Vibrio cholerae
- f. Shigella - not part of normal intestinal flora
- g. Salmonella - not part of normal intestinal flora

- XXIII. Reporting an exposure to an infectious/ communicable disease
- A. What constitutes an exposure - any specific eye, mouth, other mucous membrane, non-intact skin, parenteral contact with blood, blood products, or other potentially infectious materials should be considered an exposure incident
 - B. Why it is important to report
 1. Permits immediate medical follow up, permitting identification of infection and immediate intervention
 2. Enables the Designated Officer (DO) to evaluate the circumstances surrounding the incident and implement engineering or procedural changes to avoid a future exposure
 3. Facilitates follow up testing of the source individual if permission for testing can be obtained
 - a. Under provisions of the Ryan White Act, the exposed employee has the right to request the infection status of the source patient from the patient's health care provider, but neither the agency nor the employee can force testing of the source individual
 - b. Employers must, and should as part of an effective Exposure Control Plan, tell the employee what to do if an exposure incident occurs
 - C. Who to report to

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1. Ryan White Act stipulates that an employer will designate a person or officer within the organization to whom exposed employees will report
2. That officer will then initiate those elements of the Exposure Control Plan to comply with standards and guidelines relative to the exposure
3. Local reporting requirements
- D. Medical evaluation and follow up
 1. Employers must, by law, provide free medical evaluation and treatment to exposed employees, to include
 - a. Counseling about the risks, signs and symptoms, probability of developing clinical disease, and how to prevent further spread of the potential infection
 - b. Prescribe appropriate treatment in line with current U.S. Public Health Service recommendations
 - c. Discuss medications offered, side effects, contraindications
 - d. Evaluate any reported illnesses to determine if the symptoms could be related to HIV or hepatitis
 2. Steps involved
 - a. Blood test of exposed employee, contingent upon employee agreement
 - (1) Employee has the option to give blood sample, but refuse permission for HIV testing at the time the sample is drawn
 - (2) Employer must maintain the blood sample for 90 days in case the employee changes his/ her mind about testing, should HIV or hepatitis-like symptoms develop
 - b. A health care provider, acting as an agent of the employer, must provide counseling to the employee based on test results, provide informed consent about prophylaxis or therapeutic regimens, and implement those regimens with the approval of the employee
 - c. Vaccines should be made available to the employee, and all employees who have occupational exposure to blood and other potentially infectious materials
- E. Written opinion and confidentiality
 1. The health care provider will provide a written report to the Designated Officer (DO) of the employer, and simply identifies whether vaccination was recommended to the exposed employee, and whether or not the employee received vaccination
 2. The written report from the employee's health care provider must also note that the employee was informed of the results of the evaluation and told of any medical conditions resulting from the occupational exposure which may require further evaluation or treatment
 - a. A copy must be provided to the employee, and to the Designated Officer for the agency's files
 3. Any other elements of the medical record are confidential, and cannot be supplied to the employer
 - a. Employee must give written consent for anyone to see the records
 - b. Records must be maintained for the duration of employment plus 30 years to comply with OSHA standards on access to employee exposure and medical records
- F. Preventing disease transmission
 1. Don't go to work
 - a. If you have diarrhea
 - b. If you have a draining wound or any type of wet lesions; wait until lesions are crusted and dry
 - c. If you are jaundiced

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- d. If you have been told you have mononucleosis
- e. If you have not been treated with a medication and/ or shampoo for lice and scabies
- f. Until you have been taking antibiotics for at least 24 hours for a strep throat
- g. If you have a cold; if you must go to work, wear a surgical mask to protect your patients
- h. Ensure that your immunization status is current relative to
 - (1) MMR
 - (2) Hepatitis B, A (if deemed appropriate by your agency)
 - (3) DPT
 - (4) Polio
 - (5) Chickenpox
 - (6) Influenza (seasonally)
 - (7) Rabies, if appropriate to your occupational/ recreational risk
- i. Approach with caution, and the right attitude
- j. Control the scene - an uncontrolled scene increases the likelihood for transmission of body fluids
- k. Observe BSI
 - (1) Always wear gloves
 - (2) If chance of splash, wear protective eyewear or face shield
 - (3) If large volumes of blood are possibility, go one step further and wear gown
 - (4) When contacting a possible TB patient, wear appropriate particulate mask
- l. Patients with coughs, headaches, general weakness, recent weight loss, stiff necks, high fevers, and taking medications suggestive of an infectious process are tipoffs in history-taking, with experience, the list will get longer for you
- m. Develop your cognitive base so that you can recognize patients who may be immunocompromised
- n. Don't treat your patient differently because you think there is the possibility of an infectious process
- o. Don't avoid doing things for your patient because you think there is the possibility of an infectious process
- p. After the call, disinfect your equipment and patient compartment of the ambulance with a disinfectant (1:100 Lysol®) that claims bactericidal activity against M. tuberculosis, which will kill the hepatitis viruses
 - (1) Any soap kills HIV
 - (2) Use high level disinfection on laryngoscope blades
- q. If after a call with lice, scabies, ticks or other insect vectors
 - (1) Spray the stretcher and patient compartment with an insecticide, then wipe off/ mop up insecticide residue
 - (2) Bag the linen separately, and ensure that it not be taken home; bottom line is that it needs to be washed separately
 - (3) Report any infectious exposure to the designated officer/ manager of your agency identified as such
- 2. Effective hand washing, to include the webs of the hands
- 3. The major infectious diseases that EMS personnel should have in-depth knowledge of for purposes of regulatory compliance
 - a. HIV
 - b. Hepatitis (all types that are bloodborne)

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- c. Tuberculosis
- d. Meningococcal meningitis
- 4. The major points of each infectious/ communicable disease
 - a. Identify causative organisms as bacteria, virus, or parasite, without necessarily knowing genus and species
 - b. Modes of transmission
 - c. Signs and symptoms
 - d. How to avoid infection
 - e. Understand the concept of occupational risk
 - (1) Appreciate that infectious agent mode of entry, virulence, dose, and host resistance factors combine to define risk, or potential for infection
 - (2) Just because there is risk, doesn't mean that you will become infected
 - (3) Not all infectious diseases are communicable and do not always pose risks to family members
 - (4) Risk and potential does not necessarily equate to probability; HIV is a good example - risks for infection may appear to be high, but the probability of occupational exposure is very low (0.2-0.44%)
- 5. Identify what constitutes an exposure
- 6. Identify the local protocols associated with reporting and recording an exposure
- 7. Identify the paramedic's role and responsibility in reporting and documenting an exposure
- 8. Identify other individuals' roles and responsibilities associated with the local protocols for reporting and recording an exposure
- G. Medical and legal aspects of reporting and recording an exposure

- A. Out-of-hospital personnel deal with very few infectious disease emergencies, but must be vigilant about consequences to themselves, as well as their patients and coworkers, based on daily, often unknown exposures to infectious agents
- B. Universal/ standard precautions (applicable mostly to clinical and research facilities) for EMS personnel are superseded by body substance isolation guidelines, based upon the premise that all body fluids, in any situation, may be infectious

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